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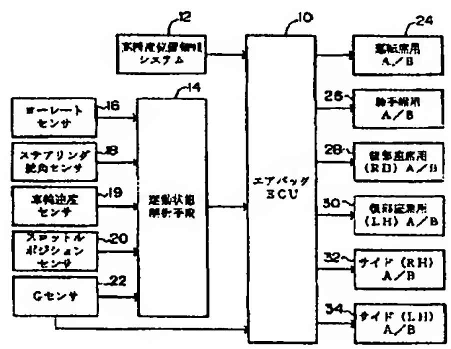
(54) CONTROL SYSTEM FOR OCCUPANT CRASH PROTECTION DEVICE

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a control system for an occupant crash protection device which enables the optimum operation of the occupant crash protection device.

SOLUTION: An air bag ECU 10 performing a deployment control of an air bag is connected with a motion state analysis means 14 for analyzing the motion state of an automobile (slip, a body slip angle and drift-out at the time of slip, for instance) and a highly accurate positional information system 12 for detecting the position of the present vehicle (present vehicle position including peripheral construction information) with high accuracy. The motion state analysis means 14 is connected with various kinds of sensors including a G sensor 22 for performing a collision confirmation for detecting the traveling state of the automobile. Based on the analysis result by the motion state analysis means 14 and a detection result of the present vehicle position by the highly accurate positional information system 12, a collision prediction is performed and the level of a threshold value of the G sensor 22 to deploy the air bag is set.



10	エアバッグECU	22	Gセンサ
12	高精度位置情報システム	24	運転席用A/B
14	運動状態解析手段	26	助手席用A/B
16	ヨーレートセンサ	28	後部座席用（RH）A/B
18	ステアリング舵角センサ	30	後部座席用（LH）A/B
19	車輪速度センサ	32	サイド（RH）A/B
20	スロットルポジションセンサ	34	サイド（LH）A/B

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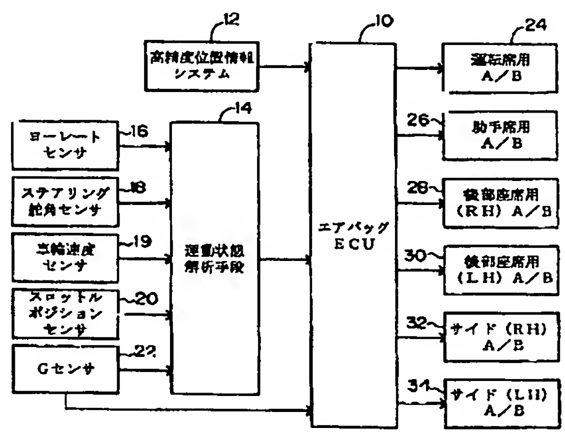
(54)【発明の名称】 乗員保護装置の制御システム

(57)【要約】
【課題】 乗員保護装置を最適に動作させることができる乗員保護装置の制御システムを提供することを目的とする。
【解決手段】 エアバッグの展開制御を行うエアバッグECU10に、自動車の運動状態（例えば、スリップやスリップ時のボディスリップ角やドリフトアウト等）を解析する運動状態解析手段14と、自車の位置（周辺の構築物情報を含む自車位置）を高精度に検出する高精度位置情報システム12を接続し、運動状態解析手段14には、自動車の走行状態を検出ための衝突確認を行うためのGセンサ22を含む各種のセンサを接続する。そして、運動状態解析手段14による解析結果及び高精度位置情報システム12による自車位置の検出結果に基づいて、衝突予測を行い、該衝突予測結果に応じて、エアバッグを展開させるためのGセンサ22のしきい値のレベルを設定する。



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(57) **Abstract**
Technical problem It aims at offering the control system of the occupant crash protection which can operate occupant crash protection the optimal.
Means for Solution A movement condition analysis means 14 to analyze the movement conditions (for example, a body slip angle, drift out, etc. at the time of a slip or a slip) of an automobile to the air bag ECU

10 which performs expansion control of an air bag, The high precision location determination system using mobile-phone 12 which detects the location (self-vehicle location including the structure information on surrounding) of a self-vehicle with high precision is connected, and various kinds of sensors containing the G sensor 22 for performing the collision check of a detection sake for the run state of an automobile are connected to the movement condition analysis means 14. And based on the analysis result by the movement condition analysis means 14, and the detection result of the self-vehicle location by the high precision location determination system using mobile-phone 12, collision prediction is performed and the level of the threshold of the G sensor 22 for developing an air bag is set up according to this collision prediction result.

Claim(s)

Claim 1 While having map information including the structure information around a transit way and detecting a self-vehicle location A self-vehicle location detection means to detect the structure around a self-vehicle, and two or more detection means to detect the run state of a self-vehicle, A movement condition analysis means to analyze the movement condition of a self-vehicle based on the run state detected by said detection means, The control system of the occupant crash protection equipped with the crew protection control means which performs collision prediction and performs initiation control of actuation of occupant crash protection according to the result of this collision prediction based on the detection result by said self-vehicle location detection means, and the analysis result by said movement condition analysis means.

Claim 2 It has further a collision-detection means for detecting the collision containing at least one side of a touch sensor which detects the contact at the time of the acceleration sensor which detects the acceleration at the time of a collision, and a collision. Said crew protection control means When a collision is detected from the detection value of said collision-detection means, while making actuation of said occupant crash protection start The control system of the occupant crash protection according to claim 1 characterized by setting up the threshold which makes actuation of the occupant crash protection of said collision-detection means start according to the result of said collision prediction.

Claim 3 Said crew protection control means is the control system of the occupant crash protection according to claim 2 characterized by setting up said threshold low rather than the case where a collision is not predicted from the result of said collision prediction when a collision is predicted from the result of said collision prediction.

Claim 4 It has further a circumference car detection means to detect a circumference car. Said crew protection control means The detection result by said self-vehicle location detection means, the analysis result by said movement condition analysis means, And the control system of occupant crash protection given in any 1 term of claim 1 characterized by performing collision prediction and performing initiation control of actuation of occupant crash protection according to the result of this collision prediction based on the circumference car detected by said circumference car detection means thru/or claim 3.

Detailed Description of the Invention

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Field of the Invention This invention starts the control system of occupant crash protection, and relates to the control system of the occupant crash protection which controls occupant crash protection especially carried in the automobile, such as a driver's seat air bag, a passenger seat air bag, a rear seat air bag, a side air bag, and pretensioner.

0002

Description of the Prior Art An automobile is equipped with air bag equipment and pretensioner which are an auxiliary safety system because of crew protection in many cases. Moreover, mainly air bag equipment has an object for a head-on collision, and an object for a side collision, has the object for operators, an object for passenger seats, an object for backseats, etc., and has the automobile carried six sets, the automobile carried eight sets.

0003 Expansion control of these air bag equipments and control of pretensioner are controlling by two or more acceleration sensors (henceforth G sensor) auxiliary, and using a contact sensor etc. **detecting the acceleration after a collision** The acceleration detected by G sensor may detect the acceleration produced when a level difference is overcome, the acceleration which joins a car body at the time of door close, and

acceleration other than the acceleration produced by collision is detected as a noise. So, the threshold of the acceleration which permits these noises is prepared and occupant crash protection, such as air bag equipment and pretensioner, is controlled by the crew protection control system which controls conventional air bag equipment, pretensioner, etc. based on this threshold.

0004 However, in this crew protection control system, there were a demand to which sensibility is reduced in order to control detection of a noise as much as possible, and a demand which is called the demand which raises sensibility in order to make it develop early and which carries out an antinomy. If a threshold is low set up when preparing a threshold in the acceleration detected by G sensor as mentioned above and judging a collision, by for example, noises, such as acceleration which joins a car body at the time of close **which were mentioned above / level difference riding **** or door close** Although the actuation by the noise is controlled if actuation of occupant crash protection, such as air bag equipment and pretensioner, may be started at an early stage and a threshold is set up highly, actuation of occupant crash protection may require time amount. Therefore, it becomes rough control to develop only the air bag equipment of a location required of required timing.

0005 In order to solve this, the collision between a collision partner car and a self-car is predicted, and the occupant crash protection which operates a crew protection device from the prediction result is proposed (refer to JP,11-263190,A). With this technique, actuation of a crew protection device is securable with high precision, using the communication link between cars effectively.

0006

Problem(s) to be Solved by the Invention However, to other goods which cannot be obtained by the communication link between cars, for example, an obstruction etc., since the conventional occupant crash protection has judged the possibility of a collision by the communication link between cars between a collision partner car and a self-car, it cannot desire to operate appropriately.

0007 This invention was accomplished that the above-mentioned problem should be solved, and aims at offering the control system of the occupant crash protection which can operate occupant crash protection the optimal.

0008

Means for Solving the Problem In order to attain the above-mentioned purpose invention according to claim 1 While having map information including the structure information around a transit way and detecting a self-vehicle location A self-vehicle location detection means to detect the structure around a self-vehicle, and two or more detection means to detect the run state of a self-vehicle, A movement condition analysis means to analyze the movement condition of a self-vehicle based on the run state detected by said detection means, It is characterized by having the crew protection control means which performs collision prediction and performs initiation control of actuation of occupant crash protection according to the result of this collision prediction based on the detection result by said self-vehicle location detection means, and the analysis result by said movement condition analysis means.

0009 According to invention according to claim 1, with a self-vehicle location detection means, while a self-vehicle location is detected with high precision, the structure around a self-vehicle is detected. That is, the structure information on the circumference in a self-vehicle location is detected by making it match with map information including the structure information around a road. For example, detection of a self-vehicle location and detection of the structure around a self-vehicle are realizable by using a well-known navigation system.

0010 With a movement condition analysis means, the movement condition (for example, behavior which self-vehicles, such as a brake lock condition, a spin state, and a drift out condition, show now) of a self-vehicle is analyzed from the run state (for example, behavior value about transit of self-vehicles, such as acceleration which joins whenever **wheel speed** , and a self-vehicle) of the self-vehicle detected by the detection means. For example, it is possible by using well-known techniques, such as VSC (Vehicle Stability Control) and ABS (Anti-lock Brake System), to analyze the movement condition of a self-vehicle.

0011 In a crew protection control means, collision prediction to the structure around a self-vehicle is performed from the movement condition analyzed by the detection result of a self-vehicle location detection means, and the movement condition analysis means. There is at least one of the distance to a collision, time amount, a direction, and the impact degrees at the time of a collision in the result of this collision prediction. And according to the result of this collision prediction, initiation control of actuation of occupant crash protection is performed. In this case, when it results in the value and magnitude which were defined beforehand about the value as a result of collision prediction, or the size of an amount, actuation of occupant crash protection can be started. Thus, since initiation control of actuation of occupant crash protection is

performed according to collision prediction, occupant crash protection can be operated corresponding to the movement condition of a self-vehicle, and the structure information on surrounding. For example, when it sees in time, and occupant crash protection can be operated to required timing and there is two or more occupant crash protection in which an independent control is possible, the occupant crash protection of arbitration can be operated alternatively and the occupant crash protection of a required location can be operated.

0012 It has further one **at least** collision-detection means of an acceleration sensor and a touch sensor like invention according to claim 2 here. When a crew protection control means sets up the threshold which makes actuation of the occupant crash protection of a collision-detection means start according to the result of collision prediction and starts actuation of occupant crash protection based on the threshold which makes actuation of occupant crash protection start After detecting a collision, it becomes possible to operate occupant crash protection certainly and appropriately.

0013 States of emergency, such as a collision, are detectable by the self-car side. This state of emergency is detectable with collision-detection means, such as acceleration and contact. As for a collision-detection means, what acquires a continuous detection value and a gradual detection value is desirable. That is, what acquires the detection value according to the condition at the time of a collision is desirable. A crew protection control means operates occupant crash protection, when this detection value is acquired. Here, since the collision prediction result is obtained, the condition at the time of a collision can be predicted and the boundary of whether to operate occupant crash protection can be predicted from this prediction result. Therefore, corresponding to the movement condition of a self-vehicle, and the structure information on surrounding, occupant crash protection can be appropriately operated by defining this boundary as a threshold of a collision-detection means, and changing a threshold according to a prediction result (increase and decrease).

0014 Moreover, like invention according to claim 3, when a collision is predicted from the result of collision prediction of a passive safety device By setting up low the threshold for making actuation of the occupant crash protection of a collision-detection means start rather than the case where a collision is not predicted from the result of collision prediction Actuation of the occupant crash protection in required timing is attained without being influenced by the noises (acceleration detected by the time of level difference riding **** and door close etc.) inputted into a collision-detection means.

0015 Although initiation control of actuation of occupant crash protection can be performed by performing collision prediction to the structure around a transit way in the above The detection result have a circumference car detection means further like invention according to claim 4, and according **crew protection control** to a self-vehicle location detection means, Based on the analysis result by the movement condition analysis means, and the detection results (for example, the existence of a circumference car, the distance to a circumference car, a direction, etc.) by the circumference car detection means, by performing collision prediction Since the collision prediction not only to the structure around a self-vehicle but the car around a self-vehicle is attained and initiation control of actuation of occupant crash protection is performed according to the result of this collision prediction It becomes possible to operate suitable occupant crash protection also not only in the collision over the structure around a transit way but in the collision over a circumference car. For example, the candidate for a collision enables a structure, a circumference car, or to predict, and initiation control of actuation of the occupant crash protection according to the candidate for a collision also becomes possible by in addition to the detection result by the above-mentioned self-vehicle location detection means, and the analysis result by the movement condition analysis means, detecting the rate of a circumference car, distance, a direction, etc. and performing collision prediction with a circumference car detection means. In addition, a circumference car detection means may detect the behavior of a circumference car further. In this case, detection hysteresis is memorized and at least one of distance, a rate, and the directions can be detected from that variation. Thereby, it can take into consideration to the collision prediction to a migration car.

0016

Embodiment of the Invention Hereafter, an example of the gestalt of operation of this invention is explained to a detail with reference to a drawing. The gestalt of this operation applies this invention to the air bag control system which performs expansion control of the air bag equipment formed in the automobile.

0017 With the gestalt of this operation, a total of six sets of the air bag equipments of the air bag equipment for driver's seats, passenger-side air bag equipment, the air bag equipment for right-and-left backseats, and the air bag equipment for a left-and-right-laterals collision (side air bag) are prepared in the automobile, and air bag equipment is explained as what controls these air bag equipments. In the following explanation, air

bag equipment is called A/B.

0018 As shown in drawing 1 , A/B24 for driver's seats is formed in the central part of a steering 36, and A/B26 for passenger seats is formed in the passenger side of an instrument panel 38. Moreover, A/B28 for right-hand side backseats (A/B for backseats (RH)) is formed in the seat-back rear-face side of a driver's seat 40, and A/B30 for left-hand side backseats (A/B for backseats (LH)) is formed in the seat-back rear-face side of a passenger seat 42. And along with the roof rail, side A/B (side (RH) A/B32 and side (LH) A/B34) is prepared in each of a drivers side and a passenger side from the front pillar.

0019 When each A/B detects an impact by G sensor mentioned later, the load at the time of a collision is eased by this bag body being developed by lighting the chemical with which it was loaded into the inflator which is the component part of A/B based on the expansion signal outputted from an air bag ECU 10, and filling up with the gas generated from this chemical in a bag body.

The air bag control system concerning the **1st operation gestalt**, next the 1st operation gestalt is explained with reference to the block diagram of drawing 2 .

0020 as show in drawing 2 , it have the air bag ECU 10 which each above-mentioned A/B be connect , swerve from the air bag control system concerning the 1st operation gestalt , and perform expansion control of A/B of ** , and a movement condition analysis means 14 analyze automobilism conditions (for example , a body slip angle , drift out , etc. at the time of a slip or a slip) , and the high precision location determination system using mobile-phone 12 which detect a self-vehicle location with high precision be connect to the air bag ECU 10 . In addition, the high precision location determination system using mobile-phone 12, the movement condition analysis means 14, and an air bag ECU 10 are equivalent to the self-vehicle location detection means of this invention, a movement condition analysis means, and a crew protection control means, respectively.

0021 Various kinds of sensors (it is equivalent to the detection means of this invention) for detecting the run state of an automobile are connected to the movement condition analysis means 14, and the sensor 19, the throttle position sensor 20, and the acceleration sensor (G sensor) 22 are connected to the movement condition analysis means 14 with the gestalt of this operation whenever **yaw rate-sensor 16, steering rudder angle sensor 18, and wheel speed** . The yaw rate sensor 16 is for detecting the yaw rate generated in an automobile, and the steering rudder angle sensor 18 is formed in a steering 36, and it detects the rudder angle of a steering 36. Moreover, a sensor 19 is whenever **wheel speed** for detecting whenever **wheel speed** based on sensors, such as a photosensor formed in each wheel of an automobile, respectively, and a throttle position sensor 20 being formed in an engine throttle body, and detecting throttle opening. Moreover, the G sensor 22 is for detecting the acceleration produced by the acceleration which is equivalent to the collision-detection means of this invention, and is produced by transit of an automobile, collision, etc. In addition, the G sensor 22 is connected to the air bag ECU 10. Moreover, two or more G sensors 22 are formed in order to detect the acceleration of the direction which intersects perpendicularly with the travelling direction and travelling direction of an automobile, and with the gestalt of this operation, the G sensor 22 which detects the acceleration of the direction which intersects perpendicularly with a travelling direction is used for them as a G sensor 22 for a side collision, using the G sensor 22 which detects the acceleration of the travelling direction of an automobile as a G sensor 22 for a head-on collision.

0022 The movement condition analysis means 14 analyzes the movement condition of an automobile based on the information acquired from each above-mentioned sensor. For example, based on the acceleration of each direction which joins the automobile detected by the throttle opening and the G sensor 22 which were detected by the throttle position sensor 20, the movement condition of automobiles, such as a spin state, a brake lock condition, a drift out condition, and a usual run state, is judged the yaw rate detected by the yaw rate sensor 16, the steering include angle detected by the steering rudder angle sensor 18, and whenever **each wheel speed / which was detected by the sensor 19 whenever / wheel speed** .

0023 In addition, the sensors connected to the movement condition analysis means 14 It is prepared in the transmission instead of what is restricted above etc. You may make it form the sensor which detects the shift position of a speed sensor or transmission which detects the rate of an automobile. As a movement condition analysis means 14 the movement condition (a spin state --) of the automobile used by control of VSC (Vehicle Stability Control) which is a well-known technique, ABS (Anti-lock Brake System), etc. It is realizable by applying a brake lock condition, a drift out condition, and the method of usually detecting a run state etc. Here, in using VSC, it judges the movement conditions of a self-vehicle including the ability of its footing to usually be regained in the movement condition by VSC.

0024 The high precision location determination system using mobile-phone 12 detects the structure which exists around a self-vehicle from the map information memorized beforehand and the detected self-vehicle

location while detecting the location of a self-vehicle with high precision. In addition, you may make it acquire map information through means of communications, such as a cellular phone.

0025 For example, it is realizable with a well-known navigation system, and a well-known navigation system receives the signal from the GPS (Global Positioning System) satellite launched by the altitude of about 20,000km with a GPS antenna, and the high precision location determination system using mobile-phone 12 positions a self-vehicle location based on the signal of this reception. Furthermore, the difference of the time of concentration of an FM multiplex broadcast can be detected, and a self-vehicle location can be positioned with high precision by amending the error included in the signal received with the GPS antenna based on the difference of this time of concentration (the so-called Differential GPS:DGPS). and while being able to carry out road guidance by collate with the map information acquire through means of communications beforehand memorized by record media , such as CD-ROM and DVD , such as map information and a cellular phone , the information around a self-vehicle location (existence of a structure , its classes (the wall of concrete , a telegraph pole , a building , a steel tower , an iron structure , a wooden building , a thin iron shutter , the bank of soil , guard rail , etc.) , etc.) be detectable .

0026 The air bag ECU 10 is constituted by circumference circuits, such as CPU, ROM and RAM which are not illustrated, and a bus, and if the acceleration beyond the predetermined value which joins an automobile by the G sensor 22 connected to the air bag ECU 10 is detected, it is constituted so that expansion of A/B connected to the air bag ECU 10 may be directed. That is, an air bag ECU 10 directs expansion of above-mentioned A/B connected to the air bag ECU 10, when G sensor 22 output (as for min, acceleration starts quickly from the standup middle gently with a collision) as shown in drawing 3 was inputted and G sensor 22 output exceeds the threshold defined beforehand. A/B is developed by this.

0027 Moreover, as mentioned above, while the high precision location determination system using mobile-phone 12 and the movement condition analysis means 14 are connected and the positional information of a self-vehicle is inputted from the high precision location determination system using mobile-phone 12, the operational status of a self-vehicle is inputted into an air bag ECU 10 from the movement condition analysis means 14. And in an air bag ECU 10, control which the threshold of the acceleration which joins an automobile is set control up and develops A/B according to the set-up threshold is performed based on the positional information of a self-vehicle, and the operational status of a self-vehicle. That is, while judging the movement condition of the self-vehicle analyzed by the movement condition analysis means 14 with the gestalt of this operation, the collision to a structure from the positional information of the self-vehicle obtained from the high-precision location determination system using mobile-phone 12 is predicted, and it has the composition of setting up the level of the threshold which develops A/B according to this prediction result, and the G sensor 22 detecting the check of a collision, and developing A/B. In addition, you may make it use sensors, such as a touch sensor, for the G sensor 22 instead.

0028 Then, expansion control of A/B is explained. In addition, the case where a car has a side collision in a structure is explained. Expansion control of this A/B sets up side collision level based on the expansion (side collision standby) level-setting map shown in drawing 4 (A) set up beforehand according to the class of structure contained in the vehicle speed of a self-vehicle and the yaw rate which are acquired from the movement condition analysis means 14, and the positional information acquired from the high precision location determination system using mobile-phone 12. And expansion control of A/B is performed based on the expansion control map shown in drawing 4 (B) beforehand set up according to the G sensor 22 detection level inputted from the set-up side collision level and the G sensor 22. In addition, the class (the 1st sort structure and the 2nd sort structure) of structure in drawing 4 (A) For example, the wall of concrete with the great impact at the time of a collision, a telegraph pole, a building, They may be made to use a steel tower, the structure of ****, etc. as the 1st sort structure, to carry out stratification of a wooden building, a thin iron shutter, the bank of soil, the guard rail, etc., and to carry out stratification to plurality like the 2nd sort structure, like ... the 4th sort the 3rd sort further. Moreover, G sensor ** level in drawing 4 is what sets up a threshold level (magnitude of a threshold). You may make it prepare further two or more level. Size into threshold level (G sensor ** level) smallness For example, as shown in drawing 3 , it is set as the level as the conventional threshold with same G sensor ** level smallness, and smallness is set up in order as a threshold smaller than G sensor ** level smallness among G sensor ** level.

0029 Then, an operation of the air bag control system constituted as mentioned above is explained with reference to the flow chart of drawing 5 . In addition, the case where a car has a side collision in a structure is explained.

0030 In an air bag ECU 10, first, high precision positional information is acquired from the high precision location determination system using mobile-phone 12 at step 100, and a movement condition analysis result

is acquired from the movement condition analysis means 14 at step 102. In addition, the information on various kinds of sensors connected to the movement condition analysis means 14 is also included in a movement condition analysis result, and it is acquired at step 102 including such information.
0031 Then, at step 104, it is judged based on whenever **wheel speed / which is contained in the movement condition analysis result acquired at step 102** whether it is under **stop** ******. This judgment judges whether it is under **stop** ****** by whether whenever **wheel speed / which was detected by the sensor 19 whenever / wheel speed / which was prepared in each wheel** is a idle state (whenever **wheel speed** is 0). When a judgment is affirmed, it returns to the above-mentioned step 100, and processing of step 100 - step 104 is repeated again.
0032 When judged with negation of the judgment of step 104, i.e., are running, it shifts to step 106 and it is usually judged based on the movement condition analysis result acquired at step 102 whether it is a movement condition (not abnormal conditions, such as a slip, a brake lock, and drift out, but condition it is running to usual). When a judgment is affirmed, it returns to step 100 and processing of step 100 - step 106 is repeated again.
0033 Moreover, when the judgment of step 106 is denied (i.e., when movement conditions are usually not a movement condition but abnormal conditions (a slip, a brake lock, drift out, etc.)), it shifts to step 108 and collision prediction count is performed based on the movement condition analysis result acquired from the positional information and the movement condition analysis means 14 which were acquired from the high precision location determination system using mobile-phone 12.
0034 In addition, as for collision prediction count, the following count is performed as an example.
0035 ** Carry out forecasting calculation of the location of the self-vehicle after Tf time amount, a rate, and e rotation by making current into time amount 0 with the movement condition analysis means 14. For example, the spin of 0.01 seconds after and a sideslip are sensed as Tf.
0036 ** Carry out repeat operation to every cycle-time delta **of this operation** T. According to a motion of a car, you may calculate in the short cycle time by the long cycle time at the time of watch (abnormal condition) at the time of usual in that case.
0037 ** Calculate a motion of the car to Te defined beforehand by time amount unit deltaT after Tf. Movement conditions, such as spin at this time and sideslipping, are sensed.
0038 ** To which the above-mentioned timing, when spin, sideslipping, etc. are predicted, arrange the structure around a self-vehicle from the positional information acquired from the high precision location determination system using mobile-phone 12, and perform forecasting calculation of after what kind of time amount to have a side collision in what at each rate **what kind of** at what kind of rate based on the movement condition acquired from the movement condition analysis means 14. That is, forecasting calculation of the prediction time amount Tc to a collision, the prediction rate Vc at the time of a collision, and the yaw rate (yaw angular velocity) Yc is carried out.
0039 ** Set up air bag expansion time amount deltaTm beforehand. Air bag expansion time amount is time amount required in order to develop A/B on the severest conditions.
0040 ** Decide on the time amount Td to judge beforehand. It is determined that the time amount to judge will serve as Td<Tc-delta Tm.
0041 Then, at step 110, it is judged based on the collision prediction calculated at the positional information and step 108 which were acquired from the high precision location determination system using mobile-phone 12 whether it collides with a structure. When a judgment is affirmed, it shifts to step 112 and expansion level setting is performed based on collision standby condition ON (A), i.e., drawing 4 .
0042 At step 114, it is judged whether the acceleration obtained from the G sensor 22 is more than an expansion threshold. That is, it is judged whether the G sensor 22 detection level (refer to drawing 4 (B)) according to the set-up expansion level was reached. When a judgment is affirmed, it shifts to step 116, and based on the G sensor 22 which detected collision prediction and acceleration, A/B to develop is determined and expansion of determined A/B (side (RH) A/B32 or side (LH) A/B34) is performed. In addition, you may make it also develop A/B other than side A/B according to the prediction include angle of a side collision etc.
0043 On the other hand, when the judgment of step 110 is denied, it shifts to step 118, when the collision standby condition is set to ON, it cancels, and when the collision standby condition is not set up, processing of return, the above-mentioned step 100 - step 110 is repeated as it is to step 100.
0044 Thus, the air bag control system concerning the gestalt of this operation Expansion level is set up based on the positional information of the self-vehicle obtained from the high precision location determination system using mobile-phone 12, and the movement condition of the self-vehicle obtained from the movement condition analysis means 14. According to this expansion level, by setting up the detection

level (threshold for developing A/B) of the G sensor 22, A/B of a location required of required timing can be developed, and expansion control of optimal A/B can be performed.
Although it assumes that the air bag control system concerning the 1st operation gestalt of the **2nd operation gestalt** has a side collision in a structure, the case where having a side collision on the circumference car of a self-vehicle is also assumed as an air bag control system concerning the 2nd operation gestalt is explained.
0045 As shown in drawing 6 to the air bag control system concerning the 1st operation gestalt, except that the circumference car detection means 44 is connected to the air bug ECU 10, since the air bag control system concerning the 2nd operation gestalt is the same configuration, it attaches the same sign and omits a part of explanation.
0046 The circumference car detection means 44 detects the car which runs the circumference of a self-vehicle, and it is constituted so that a detection result may be outputted to the air bug ECU 10. Detection (distance to a circumference car etc.) of a circumference car is realizable by using techniques, such as a sensor which detects the distance between two cars which is a well-known technique as the circumference car detection approach, and a communication link between vehicles.
0047 Then, expansion control of A/B is explained. In addition, the case where the other car has a side collision on a self-vehicle is explained. Expansion control of this A/B sets up side collision level based on the expansion (side collision standby) level-setting map shown in drawing 7 (A) set up beforehand according to the rate of the circumference car (watch car) acquired from the rate of a self-vehicle and the circumference car detection means 44 which are acquired from the movement condition analysis means 14. And expansion control of A/B is performed based on the expansion control map shown in drawing 7 (B) beforehand set up according to the G sensor 22 detection level inputted from the set-up side collision level and the G sensor 22. In addition, G sensor ** level in drawing 7 is what sets up a threshold level (magnitude of a threshold). You may make it prepare further two or more level. Size into threshold level (G sensor ** level) smallness For example, as shown in drawing 3 , it is set as the level as the conventional threshold with same G sensor ** level smallness, and smallness is set up in order as a threshold smaller than G sensor ** level smallness among G sensor ** level.
0048 Then, an operation of the air bag control system concerning the 2nd operation gestalt is explained with reference to the flow chart of drawing 8 . In addition, about the same processing as the flow chart of drawing 5 , the same sign is attached and explanation is omitted in part.
0049 In an air bag ECU 10, first, high precision positional information is acquired from the high precision location determination system using mobile-phone 12 at step 100, and a movement condition analysis result is acquired from the movement condition analysis means 14 at step 102. In addition, the information on various kinds of sensors connected to the movement condition analysis means 14 is also included in a movement condition analysis result, and it is acquired at step 102 including such information.
0050 Next, at step 103, circumference car information is acquired from the circumference car detection means 44.
0051 Then, at step 104, it is judged based on whenever **wheel speed / which is contained in the movement condition analysis result acquired at step 102** whether it is under **stop** ******. Namely, it judged based on whenever **wheel speed / which was prepared in each wheel** whether it is under **stop** ******. This judgment judges whether it is under **stop** ****** by whether whenever **wheel speed / which was detected by the sensor 19 whenever / wheel speed / which was prepared in each wheel** is a idle state (whenever **wheel speed** is 0). When a judgment is affirmed, it returns to the above-mentioned step 100, and processing of step 100 - step 104 is repeated again.
0052 When judged with negation of the judgment of step 104, i.e., are running, it shifts to step 106 and it is usually judged based on the movement condition analysis result acquired at step 102 whether it is a movement condition (not abnormal conditions, such as a slip, a brake lock, and drift out, but condition it is running to usual). When a judgment is affirmed, it returns to step 100 and processing of step 100 - step 106 is repeated again.
0053 Moreover, when the judgment of step 106 is denied (i.e., when movement conditions are usually not a movement condition but abnormal conditions (a slip, a brake lock, drift out, etc.)), it is judged whether it shifts to step 107 and there is any circumference car from the circumference car information acquired at step 103. In addition, the judgment of whether there is any circumference car judges the travelling direction of a self-vehicle from the movement condition acquired from the positional information and the movement condition analysis means 14 which are acquired from the high precision location determination system using mobile-phone 12, and it is judged whether a circumference car is in this travelling direction. When a

judgment is denied, processing after step 108 of the 1st operation gestalt and same processing are performed.

0054 When the judgment of step 107 is affirmed, it shifts to step 120 and collision prediction count to a circumference car is performed.

0055 In addition, as for the collision prediction count to a circumference car, the following count is performed as an example.

0056 ** Carry out forecasting calculation of the location P 1 hour after **of a self-vehicle** T, a travelling direction, and the rate for every fixed cycle based on the movement condition acquired from the movement condition analysis means 14.

0057 ** Detect the other car approached from the side with the circumference car detection means 44 to the location 1 hour after **of a self-vehicle** T, and extract risk within the limits 1 hour after T (for example, less than 2 etc.m of a self-vehicle etc.). At this time, it is desirable for the positional information acquired by the high precision location determination system using mobile-phone 12 to also use the other car which passes by grade separation to prevent mistakes.

0058 ** Presume the location of the other car approached from the sideT1 hour after air bug ECU by ten, a direction, an include angle, and a rate. Moreover, if it collides, the judgment of right-hand side or left-hand side is performed.

0059 Then, at step 122, it is judged based on the collision prediction to the circumference car calculated at the positional information and step 120 which were acquired from the high precision location determination system using mobile-phone 12 whether it collides with a circumference car. When a judgment is affirmed, it shifts to step 124 and expansion level setting is performed based on collision standby condition ON (A), i.e., awing 7 . And it shifts to the above-mentioned step 114, and it is judged whether the acceleration obtained from the G sensor 22 is more than an expansion threshold. That is, it is judged whether the G sensor 22 detection level (refer to drawing 7 (B)) according to the set-up expansion level was reached. When a judgment is affirmed, it shifts to step 116, and based on the G sensor 22 which detected collision prediction and acceleration, A/B to develop is determined and expansion of determined A/B (side (RH) A/B32 or side (LH) A/B34) is performed. In addition, you may make it also develop A/B other than side A/B according to the prediction include angle of a side collision etc.

0060 On the other hand, when the judgment of step 122 is denied, it shifts to step 126, when the collision standby condition serves as ON, it cancels, and when the collision standby condition is not set up, the processing from return and the above-mentioned step 100 is repeated as it is to step 100.

0061 Thus, the air bag control system concerning the 2nd operation gestalt The positional information of the self-vehicle obtained from the high precision location determination system using mobile-phone 12 like the 1st operation gestalt, And by setting up expansion level based on the movement condition of the self-vehicle obtained from the movement condition analysis means 14, being according to this expansion level and setting up the detection level (threshold for developing A/B) of the G sensor 22 A/B of a location required of required timing can be developed, and expansion control of optimal A/B can be performed.

0062 Moreover, based on the rate of the circumference car obtained from the circumference car detection means 44, and the rate of the self-vehicle obtained from the movement condition analysis means 14, expansion level is set up, and it responds to this expansion level, and is the detection level (by setting up the threshold for developing A/B, A/B of a required location can be similarly developed to required timing to a circumference car.) of the G sensor 22.

0063 In addition, although it was made to perform A/B expansion control with the gestalt of the above-mentioned operation according to the detection level of the G sensor 22, it is also possible to predict a collision and to develop an air bag by the visual sensor and its information processing (a CCD camera, a RADAR, laser, etc.), before a collision. The operation time starts performing an accurate image processing. Therefore, it is more realistic to choose the image processing which gave priority to the operation time at the sacrifice of precision. Moreover, it is so inaccurate that visual-sensor information has far prediction time amount, and uncertain. Therefore, a uncertainty can be reduced by combining with the above-mentioned high precision location determination system using mobile-phone. In carrying out expansion control of the air bag using a visual sensor, according to the visual-sensor information level (possibility judged by the visual sensor of colliding) obtained from the expansion level-setting map shown in drawing 4 (A) or drawing 7 (A), and a visual sensor, the expansion control map shown in drawing 9 (A) is set up beforehand, and it performs expansion control of an air bag based on the set-up expansion control map.

0064 Moreover, you may make it use the G sensor 22 and a visual sensor as a check of a collision. According to the rate of the circumference car obtained from the circumference car detection means 44, and

the rate of the self-vehicle obtained from the movement condition analysis means 14, on in this case, the expansion level-setting map (refer to drawing 4 (A) and drawing 7 (A)) set up beforehand Compound expansion level is set up on the compound expansion (side collision standby) level-setting map which shows side collision level to drawing 9 (B) which set up and was beforehand set up according to the side collision level and visual-sensor sensing level which were set up. And it is also possible to improve expansion precision further by performing expansion control of A/B based on the compound expansion control map shown in drawing 9 (C) beforehand set up according to the G sensor 22 detection level inputted from the set-up compound expansion level and the G sensor 22.

0065 In addition, although the gestalt of the above-mentioned operation raised and explained the air bag to the example as occupant crash protection, it is possible not to restrict to this and to apply to the control system of occupant crash protection, such as pretensioner. Moreover, although side A/B in the gestalt of the above-mentioned operation was explained as a drivers side (side (RH) A/B32) and a passenger side (side (LH) A/B34) good also as further two or more side A/B for example, not the thing to restrict to this but the object for driver's seats, the object for passenger seats, for backseats (right/left), etc. -- it carried out and A/B for head protection and A/B for body protection were further prepared as side A/B for the object for driver's seats, and passenger seats -- side A/B may be carried out.

0066 Moreover, although it was made to develop A/B with the gestalt of the above-mentioned operation when the threshold of the G sensor 22 set up according to collision prediction was exceeded, it is also possible to develop A/B from collision prediction of step 108 and step 120.

0067 Furthermore, although especially the collision after the 2nd times is not explained (for example, when a right lateral collides first, time amount is overdue and a left lateral collides etc.), you may make it apply .s invention also to the collision after the 2nd times with the gestalt of the above-mentioned operation. For example, expansion control of side A/B located in right-hand side with the application of this invention when a right lateral collides first is performed, then when time amount is overdue and a left lateral collides, expansion control of side A/B located in left-hand side with the application of this invention is performed.

0068

Effect of the Invention Since the movement condition of a self-vehicle is analyzed, collision prediction is performed based on the movement condition of a self-vehicle location and a self-vehicle, while detecting a self-vehicle location according to this invention as explained above, and initiation control of actuation of occupant crash protection is performed according to the result of this collision prediction, it is effective in the ability to operate occupant crash protection the optimal.

Brief Description of the Drawings

Drawing 1 It is a schematic diagram for explaining arrangement of air bag equipment.

Drawing 2 It is the block diagram showing the outline configuration of the air bag control system concerning the 1st operation gestalt of this invention.

Drawing 3 It is drawing showing the output of G sensor.

Drawing 4 (A) shows the expansion level-setting map in the 1st operation gestalt, and (B) is drawing showing the expansion control map in the 1st operation gestalt.

Drawing 5 It is a flow chart for explaining an operation of the air bag control system concerning the 1st operation gestalt of this invention.

Drawing 6 It is the block diagram showing the outline configuration of the air bag control system concerning the 2nd operation gestalt of this invention.

Drawing 7 (A) shows the expansion level-setting map in the 2nd operation gestalt, and (B) is drawing showing the expansion control map in the 2nd operation gestalt.

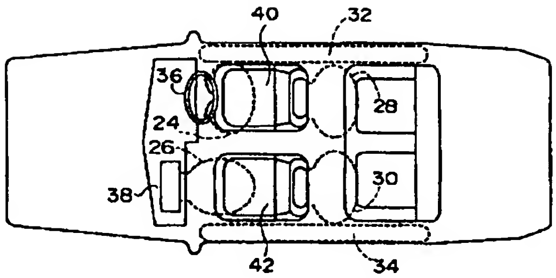
Drawing 8 It is a flow chart for explaining an operation of the air bag control system concerning the 2nd operation gestalt of this invention.

Drawing 9 (A) shows the expansion control map at the time of using a visual sensor, (B) shows the compound expansion level-setting map which used the visual sensor and G sensor, and (C) is drawing showing the compound expansion control map which used the visual sensor and G sensor.

Description of Notations

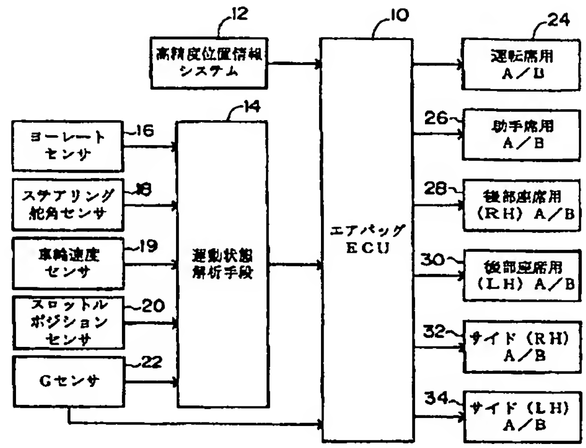
10 Air Bag ECU
12 High Precision Location Determination System Using Mobile-phone
14 Movement Condition Analysis Means

【図1】



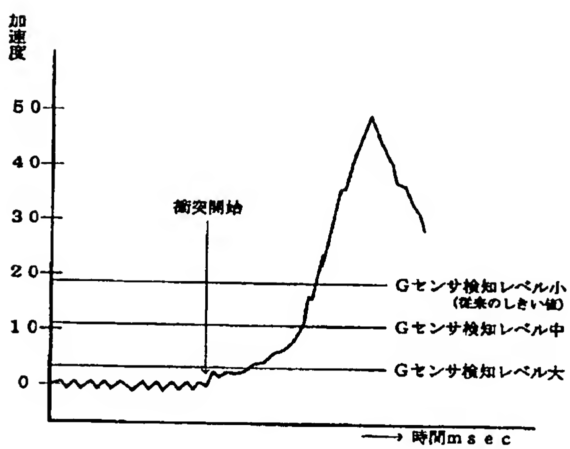
24　運転席用A／B
26　助手席用A／B
28　後部座席用（RH）A／B
30　後部座席用（LH）A／B
32　サイド（RH）A／B
34　サイド（LH）A／B

【図2】

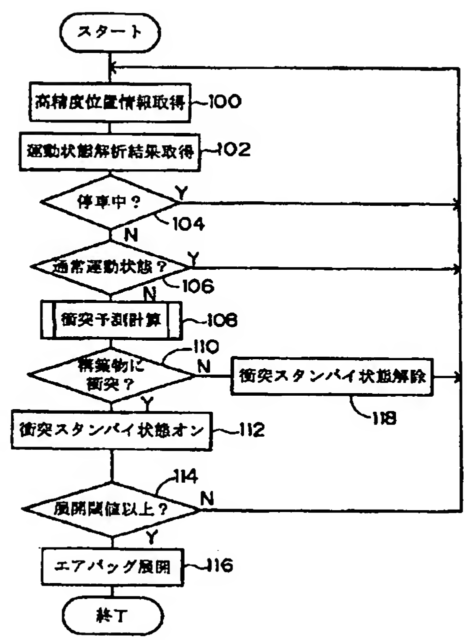


10	エアバッグECU	22	Gセンサ
12	高精度位置情報システム	24	運転席用A／B
14	運動状態解析手段	26	助手席用A／B
16	ヨーレートセンサ	28	後部座席用（RH）A／B
18	ステアリング舵角センサ	30	後部座席用（LH）A／B
19	車輪速度センサ	32	サイド（RH）A／B
20	スロットルポジションセンサ	34	サイド（LH）A／B

【図3】



【図5】



【図４】

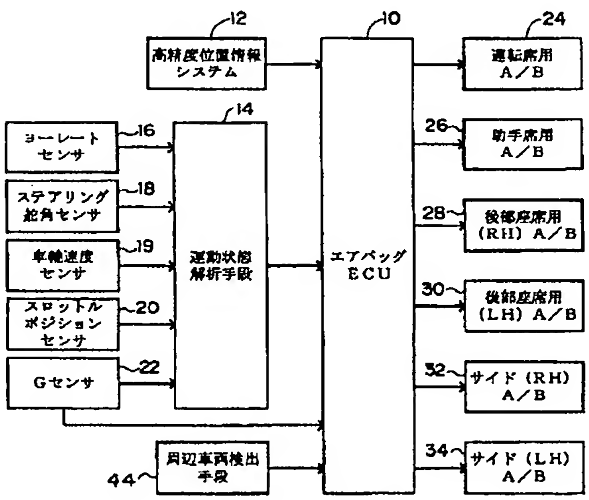
(A)展開(側面衝突スタンバイ)レベル設定

	ヨー速度 大		ヨー速度 中		ヨー速度 小	
	第1種構築物	第2種構築物	第1種構築物	第2種構築物	第1種構築物	第2種構築物
車速 大	レベル1	レベル1	レベル1	レベル2	レベル2	レベル2
車速 中	レベル1	レベル1	レベル2	レベル2	レベル3	レベル3
車速 小	レベル2	レベル3	レベル3	レベル3	レベル3	レベル3

(B)展開制御マップ

Gセンサ検知レベル	側面衝突レベル		
	レベル1	レベル2	レベル3
小	展開	待機	待機
中	展開	展開	待機
大	展開	展開	展開

【図６】



【図７】

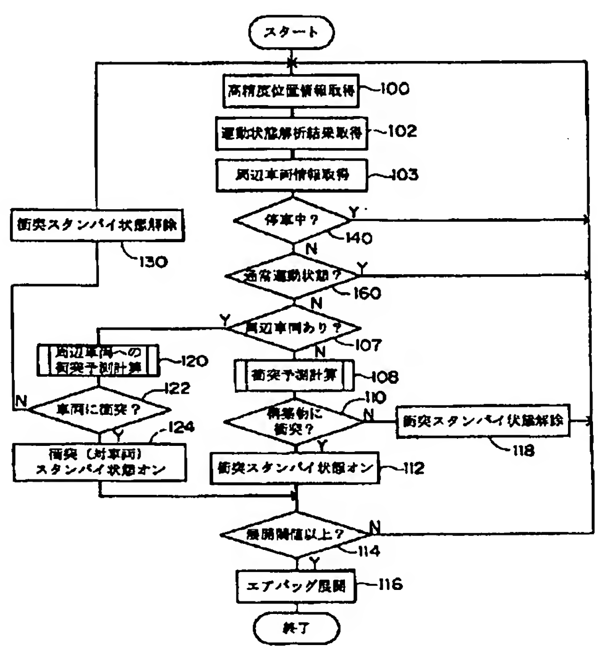
(A)展開(側面衝突スタンバイ)レベル設定

		周辺車両の速度		
		大	中	小
自車の速度	大	レベル1	レベル2	レベル3
	中	レベル2	レベル3	レベル3

(B)展開制御マップ

Gセンサ検知レベル	側面衝突レベル		
	レベル1	レベル2	レベル3
小	展開	待機	待機
中	展開	展開	待機
大	展開	展開	展開

【図８】



【図９】

(A)展開制御マップ

視覚センサ感知レベル	側面衝突レベル		
	レベル1	レベル2	レベル3
小	展開	待機	待機
中	展開	展開	待機
大	展開	展開	展開

(B)複合展開レベル設定マップ

		複合展開レベル		
		レベル1	レベル2	レベル3
視覚センサ感知レベル	小	L2	L3	L3
	中	L1	L2	L3
	大	L1	L1	L2

(C)複合展開制御マップ

Gセンサ感知レベル	側面衝突レベル		
	L1	L2	L3
小	展開	待機	待機
中	展開	展開	待機
大	展開	展開	展開

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Applicant: Belau et al.

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